

Rocky Flats Environmental Technology Site: Actinide Migration Evaluation

Meetings July 22-24, 2002

Advisory Group Greg Choppin, David Clark, David Janecky, Leonard Lane,
Annie Kersting

Summary and Recommendations for Path Forward

Site personnel are using advanced technology developed by the AME in Site Operations. For example, the Actinide Migration Pathway Report and Site-Wide Water Balance modeling documents are being used in Site configuration planning and we look forward to further integration and to additional applications of these technologies in the future. Plans and options for the Old Process Waste Lines remain an important area of development for the Site. We were encouraged by the presentation of the knowledge and understanding of historical usage and present state of these systems. Isotope ingrowth and potential for uncharacterized risk can be evaluated from previous calculations for Am(241) ingrowth, and amounts to very small contributions to radioactivity amounts. Comparison of the state of understanding for radionuclide contamination transport between INEEL and RFETS can be valuable for further refinement of the pathway details for RFETS, but made difficult at this point due to the different state of development of site-wide evaluations and analysis of transport pathways. Documentation available from INEEL and other DOE sites should continue to be collected and evaluated as integrated studies are completed. Transition to stewardship is developing, but continues to need attention in areas of infrastructure requirements for measurements and assessment criteria, both for near term actions and communication between DOE and Kaiser-Hill.

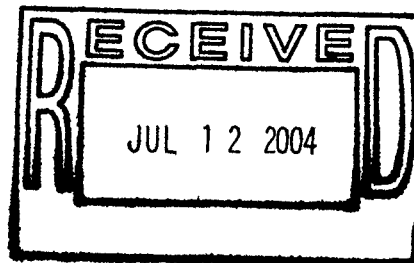
Progress and Integration

The Advisors are pleased to see the degree of integration evident in applications of the Site-Wide Water Balance (SWWB) model and its results in the Water Management Closure Plan. This Plan depends on the SWWB model and, of necessity, spans Site closure in 2006 to deal with the final pond configuration.

The subsoil exposure potential map development effort is an excellent example of application of the pathway analysis approach, integrating erosion, IHSS and slump process information.

Kaiser-Hill Company, LLC
Classification Exemption CEX-072-99

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07/12/04

ADMIN RECORD

SW-A-004974

Results and Discussions

Poison in Vadose Zone (LeRoy memo response)

Members of the AME advisory panel are indeed familiar with the two reports, "Poison in the Vadose Zone" (Makhijani & Boyd, 2001, IEER) and "IEER/Science for Democratic Action" (volume 10, number 1, 2001). The premise of both reports is that plutonium is migrating rapidly through the vadose zone at INEEL. It is our general opinion that the state of understanding of data collection and analysis in support of understanding of actinide transport pathways at INEEL and RFETS are not comparable, at present. Eight years ago, RFETS found itself in a situation similar to that currently at INEEL, with issues being raised about migration of plutonium in RFETS soils, surface-, and ground waters based on limited data. The RFETS Actinide Migration Evaluation group was formed to bring in additional external expertise to carefully examine the data, advise on the collection of new data, more sophisticated experiments and models, and quantify the various pathways for actinide migration on and off site. This approach utilized an implicit adaptive management strategy that began with a conceptual model, a critical review and selection of qualified data sets, a series of new experiments, new models, and new assessments to reach the present understanding. The conclusion that the predominant pathways for plutonium migration are by air and surface water erosion are backed up by integrated monitoring, site sampling, state-of-the-art scientific experimentation (XANES, CUFF, SEM, etc.) and models (WEPP, HEC6T, MIKE SHE).

It is our opinion that the claims made by the above mentioned reports ("Poison in the Vadose Zone" and "IEER/Science for Democratic Action, v10 1") are not robust at this early stage in understanding, as INEEL has not completed a similar detailed pathway analysis. The highly variable results for plutonium at INEEL are reminiscent of the state of understanding of plutonium data and migration at RFETS in 1995. Through completion of the detailed pathway analysis at RFETS, it has been concluded that plutonium and americium transport at RFETS is controlled by physical particulate transport processes (where wind and surface water erosion dominate the migration), in contrast to uranium. It is likely that similar transport mechanisms are operable at INEEL and that substantial differences will be found in the behavior of the wider range of radionuclide contaminants at INEEL. This is especially the case for the vadose zone where dissolved transport is the dominant mechanism, and particulate transport is very small.

Transition to Stewardship J Rampe

The AME Advisors reviewed John Rampe's draft document on Stewardship and feel it is well done and forward looking. We recognize that Rampe has dealt with long-term stewardship, assuming the Site had been closed and reached some desired end-state. This leaves the near-term (from closure to when long-term stewardship is established) as a critical period. Actions taken during the near-term will significantly influence closure and the success of

transition to long-term stewardship. Therefore, the AME group is in the process of preparing a draft strategy document describing steps, issues and methods required to successfully transition from now to long-term stewardship.

CAB question on isotope ingrowth

The CAB staff has raised a question about decay of Pu-239 and the potential for uncharacterized risk in water due to daughter products resulting from such decay. As presented in previous meetings regarding evaluation of potential for ingrowth of Am-241, members of the advisory group have calculated daughter isotope production for a variety of initial mixtures of Pu and Am isotope contamination source material. The results of these previous calculations directly relate to this present question. On a Ci basis, all daughter products remain below 0.007% of the initial Pu-239 concentration over a calculated 1000-year period (see attached figure for isotope ratios to Pu-239). U-235 is the fourth most abundant daughter product, growing in to a ratio of approximately 0.0001%. Np-237, Pa-233 and U-236 are the most abundant daughter products that grow in over 1000 years, to ratios of approximately 0.0065%, 0.0065% and 0.00054%, respectively. The chemical behavior of atoms of these isotopes within the actinide containing colloidal particles and soils will be diverse, ranging from being mechanically/chemically contained to being ejected to adjacent water by recoil. There is research in this area for natural uranium decay and natural radon production, however, for these Pu contamination concentrations of interest at the Site, the daughter concentrations are so low that they are well below the intrinsic variability of contamination and natural background radioactivity.

Statement on OPWL status

The AME advisory group met with Nick Demos to discuss the present state of understanding of the process waste lines on site. Nick had an impressive historical and working knowledge of the OPWLs, and presented detailed and logical arguments to justify ER actions in this area. Nick's discussion was authoritative, informative and enlightening. Nick addressed many of our concerns, and we recommend that ER prepare a briefing for public dissemination.

Starting with a map of the process waste lines, Nick pointed out the differences between new and old lines. For new waste lines, secondary containment captured known leaks, preventing it from reaching the soil. Moreover, these lines have been leak tested, can be readily cleaned, and are governed under RCRA. For old waste lines, Nick described a detailed knowledge of process history, discussed which lines contained non-radioactive wastes, which lines contained uranium waste, which lines contained plutonium, etc. Based on this discussion, it was easy to follow the logic used to narrow the focus to those waste lines of real concern. In addition, process history was described to pinpoint sources of known leaks, and therefore identify candidates for remedial action. As a result of this discussion, the advisors are much more

comfortable with the Site strategy for remedial action of the OPWLs. It is highly recommended that the Site consider preparing a briefing of this material in the same logical progressive fashion for presentation to the stakeholders.

It is likely that dilute plutonium waste solutions that leaked from OPWLs to surrounding soils will ultimately approach near-neutral environmental pH. At this time, plutonium will hydrolyze, become insoluble, and likely bind to soil particles. This ultimate disposition and speciation should be verified with synchrotron radiation studies.

Setting up a process/experiments for help determine Pu solubility & speciation in the Old Process Waste Lines

Given the total length and number of these OPWL, a program of sampling to validate location of leaks and extent of release of Pu in these leaks must be guided by a set of directions designed to result in essentially no leaks being missed. At the same time, the number of samples must be held to a reasonable (in time and costs) level. The following are proposed criteria for obtaining these goals:

- Selection of sampling sites
 - Known leak sites
 - Possible leak sites
 - Non-leakage sites
- Sampling depth
 - From 1 – 6 feet depth, depending on location of OPWL being sampled
 - Some samples at 1 in, 6 in and 1 foot above and at these distances below OPWL
 - Some samples 1 in, 6 in and 1 foot to left and at these distances to right of OPWL
- Number samples
 - 2 – 4 samples at each known leak site
 - 4 – 6 samples at each possible leak site
 - 2 at spaced non-leakage sites along OWPC
- Mode of Analysis
 - Large enough sample to measure if radioactivity is above background level
 - If concentration of Pu sufficient, attempt to define oxidation state
 - Filter sample water to determine particulate (colloids) versus dissolved concentrations
 - If too low for above, then acidify sample, filter & measure total leached Pu

Documents Provided to Advisory Group

Original process waste line sampling and remediation strategy documentation –
h/o RFCA PC meeting 6/26/2002
Email to Christine Dayton from Bob Nininger on CAB question about U-235
ingrowth from Pu-239 decay
Subsoil exposure potential map – draft
Original process waste lines and new process waste lines in the 700 area map
Roback, R C (2002) Initial report for the aquifer background study Summary
of uranium and plutonium data from INEEL groundwater samples LANL
LA-UR-02-3705
Roback, R C, Efur, D W , Murrell, M T , Steiner, R E , and Duffy C J (2000)
Assessment of uranium and plutonium in the saturated and unsaturated
zones beneath the subsurface disposal area, INEEL LANL LA-UR-00-
5471
Pathway Report, Erosion Modeling and Water Balance Report reviews and
responses
Proceedings of the Symposium on the Management of Prairie Dog Complexes
for the Reintroduction of the Black-footed Ferret, Biological Report 13, July
1993, Fish and Wildlife Service, US Department of Interior
Rocky Flats envision, July 17, 2002, volume 8, number 14

Documents and Information Requested for Advisory Group

Historical release documentation summary for process waste lines
Excel file with complete data set Kriged for Figure TA-A-1 (Actinide Migration
Evaluation Pathway Report Pu/Am Ratio for Surface Soil Samples to DRJ

Requests for Future Presentations and Information

Further information on releases and residual contamination from process waste
lines

Participants in AMS technical meetings**Name Organization**

| | |
|---------------------|---------------|
| David Clark | Los Alamos |
| David Janecky | LANL |
| Leonard Lane | Tucson |
| Greg Choppin | Florida State |
| Annie Kersting | LLNL |
| Chris Dayton | K-H |
| Russell McCallister | DOE/RFFO |
| Ian Paton | WWE |
| Nick Demos | K-H |
| Chris Hawley | WWE |
| Rachael Peterson | WWE |
| Lee Norland | K-H |
| David Shelton | K-H |

Future Meetings

October 7—meet with Coalition of Local Governments on stewardship
October 21-23 – 2002 conclusion & 2003 kickoff meeting
January 6-8 – 2003 initial quarter meeting

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Ci ratios sorted by abundance

